New isotopic data for bottlenose dolphins in the Balearic Islands

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Introduction

Bottlenose dolphins, *Tursiops truncatus* (Montagu,1821), is one of the most know cetacean species in the world (Leatherwood and Reeves, 1990; Wells and Scott, 2002). However, at the Mediterranean, knowledge is considerable little. Carbon and nitrogen stable isotopes and organochlorine concentrations of stranded dolphin tissues have been used to investigate population structures (Borrell *et al.*, 2006) but until now, no studies using only stable isotope analysis of biopsies on living dolphins, have been conducted. For the first time, carbon and nitrogen stable isotopes of living *Tursiops truncatus'* muscle tissues have been assessed in order to study dolphin's connectivity between populations in the Balearic Islands. Carbon and nitrogen stable isotopes have been used previously as tracers to examine trophic relationships and origins of preys in marine food webs. Nitrogen isotopic values can be used to quantitatively asses trophic level, while carbon isotopic values are generally applied to indicate relative contributions to the diet of different potential primary sources in a food web, giving evidence of inshore versus offshore food intake (Smith *et al.*, 1996; Lepoint *et al.*, 2000).

Materials and Methods

Superficial muscle from the posterior region of the dorsal fin was extracted from 34 bottlenose dolphins from March 2009 to May 2011 around the Balearic Islands. Muscle samples were collected on a remote biopsy with a clean and sterilized dart from living bottlenose dolphins. $\delta^{13}C$ and $\delta^{15}N$ stable isotopes were analyzed following standard procedures (Deudero *et al.*, 2004). The analytical precision of stable isotopes was of 0.05 ‰ for $\delta^{13}C$ and 0.06 ‰ for $\delta^{15}N$. Stable isotopes ratios were expressed in δ (‰). PERMANOVA tested significant spatial differences amongst sites. Carbon and Nitrogen isotopes were treated separately. Feasible contribution (%) of prey species to bottlenose dolphin`s diet was assessed with an Isotopic mixing model (SISUS) (http://statacumen.com/sisus).

Results

Results show differences amongst locations on carbon and nitrogen stable isotopic values amongst dolphin populations. Individuals from Canal site are the most enriched in nitrogen with mean values of 15.31 ± 0.62‰ while individuals from Andratx site are the most depleted in nitrogen with mean values of 12.87 ± 0.30‰. For carbon isotopic values, individuals from Migjorn site are the most enriched with mean values of -14.55 ± 0.32‰ and individuals from Andratx are the least enriched with mean values of -15.24 ± 0.32‰ (Figure 1). Results of prey contribution by mixing models have demonstrated a high contribution due to *Octopus* sp (26.50%) at Andratx and *Diplodus annularis* (39,95%) at Migjorn site.

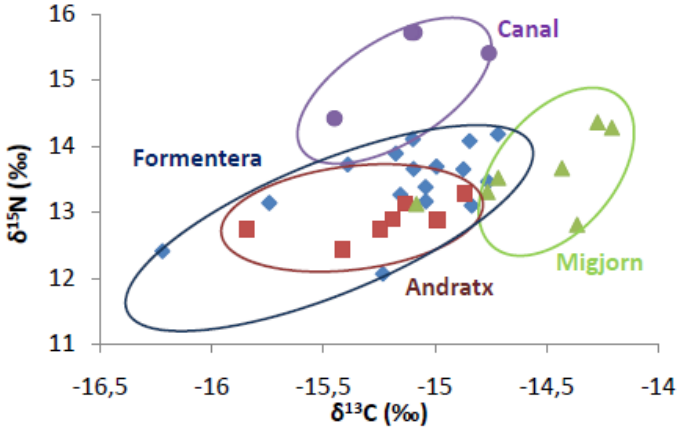

Fig. 1. Values of $\delta^{13}C$ and $\delta^{15}N$ obtained by means of remote biopsies in muscles samples of living bottlenose dolphins around the Balearic Islands.

Discussion

Results have shown spatial differences in stable isotopic composition of living bottlenose dolphins amongst the studied sites reflecting a degree of site fidelity and an indication of population fragmentation. Different prey contribution to dolphin diets has been exhibited at spatial scales reflecting site fidelity effects which can have strong impacts on population dynamics of *Tursiops truncatus* at the Balearic Islands. The existing oceanographic regime (Monserrat *et al*., 2008) probably explains the enrichment in nitrogen isotopic signals of canal site samples. From this study it has been seen that isotopic analysis can be an efficient tool, complementary to other analytical techniques, to determine population dynamics of bottlenose dolphins and that stable isotopes from living organisms provide promising results.

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References

Leatherwood, S and Reeves, R.R. (edit.). 1990. The bottlenose dolphin. XVIII, 653p. Academic Press.

Wells, R.S. and Scott, M.D. 2002. Bottlenose dolphins: *Tursiops aduncus* and *Tursiops truncatus*. In Enciclopedia of Marine Mammals. W.F., Perrin, B., Würsic and J.G.M., Thewissen (Eds). pp. 122-128. Academic Press, San Diego, California, USA.

Borrell, A., Aguilar, A., Tornero, V., Sequeiro, M., Fernández, G. and Alis, S. 2006. Organochlorine compounds and stable isotopes indicate bottlenose dolphin subpopulation around the Iberian Peninsula. *Environment International*, 32: 516-523.

Smith, R.J., Hobson, K.A., Koopman, H. N. and Lavigne, D. M. 1996. Distinguishing between populations of fresh- and salt water harbour seals (*Phoca vitulina*) using stable-isotope ratios and fatty acid profiles. *Canadian Journal of Fisheries and Aquatic Sciences*, 53: 272-279.

Lepoint, G., Nyssen, F., Gobert, S., Dauby, P. and Bouquegneau, J.-M. 2000. Relative impact of a seagrass bed and its adjacent epilithic algal community in consumer diets. *Marine Biology*, 136 (3): 513-518

Deudero , S., Pinnegar, J.K., Polunin, N. V. C., Morey G. and Morales-Nin, B. 2004. Spatial variation and ontogenic shifts in the isotopic composition of Mediterranean littoral fishes. M*arine Biology*, 145: 971-981

http://statacumen.com/sisus

Monserrat, S., López-Jurado, J.L. and Marcos, M. A. 2008. mesoscale index to describe the regional circulation around the Balearic Islands. *Journal of Marine Systems*, 71: 413-420.